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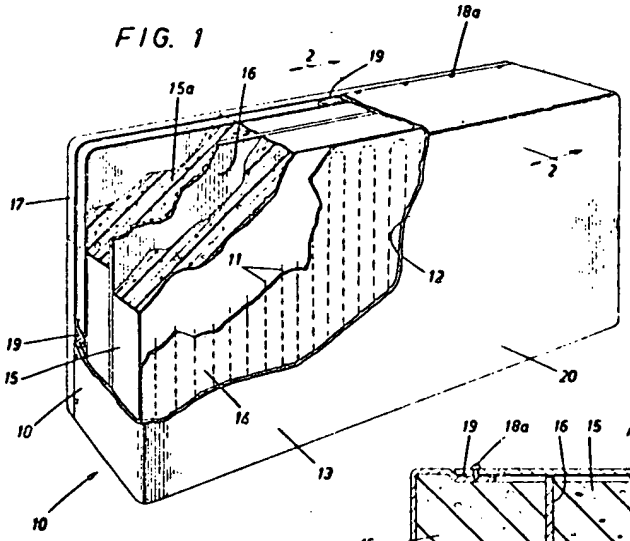
RADIANT SPACE HEATER

FIG. 1



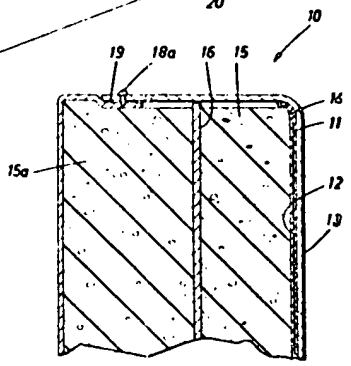


FIG. 2

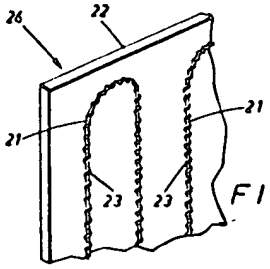


FIG. 3

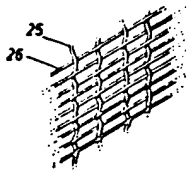
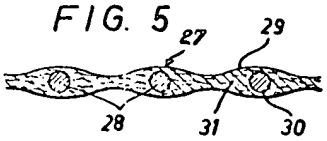


FIG. 4

FIG. 5



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CANADA
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CANADIAN PATENT

RADIANT SPACE HEATER

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Granted to Cerametal Industries Limited, Streetsville, Ontario, Canada

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No. OF CLAIMS 6

This invention relates to space heaters. It is particularly directed to an improved radiant space heater of the electric panel type.

Electric radiant space heaters are well known in the art and provide quick and efficient sources of heat. However, it has been a problem inherent in space heaters of both the exposed and enclosed element types to maintain a reasonably practical heater element life. The electric heater element, which usually consists of resistance wire, ribbon or the like, either alone or in combination with a supporting member, in both exposed and enclosed element heaters, usually reaches operating temperatures as high as 700°F. to provide an adequate heat supply. Since the element is usually in contact with air it rapidly deteriorates by oxidation at these high temperatures, necessitating frequent replacement.

We have found that by securing the heating element in proximity to a metal heat conductive sheet by means of a high-temperature electric-insulating adhesive or cement, the above problems are substantially overcome without adversely affecting the overall efficiency of the heater. The adhesive or cement secures the heating element in proximity to the heat conductive sheet throughout the length and breadth of the element to permit rapid heat dissipation from the element to the heat radiating metal sheet and thus permits maintenance of the element at a uniformly low operating temperature while functioning as an

electric insulator and serves to protect the element from deterioration.

By securing the heater element to an inner wall of a rigid enclosure formed from sheet metal such that the front face of the housing functions as the heat emissive surface, an efficient panel type radiant space heater is provided which is protected from the normal electrical appliance hazards while ensuring a long and useful element life.

It is therefore an important object of this invention to maintain the heater element of a radiant space heater in proximity to the heat conductive sheet throughout the length and breadth of the element and thus promote transfer of heat from the heating element to the heat conductive sheet and maintain a uniformly low element temperature.

Another important object of the invention is to provide means for electrically insulating the electrical heating elements from the heat conductor sheet.

A further important object of the invention is to provide means for protecting the electrical heating elements from deterioration, such as by oxidation and the like.

A still further important object of this invention is the provision of an efficient panel heater which can be quickly, readily and economically fabricated in a plurality of sizes and shapes and which is safe in operation from the normal hazards of use.

An understanding of this invention can be obtained from the following detailed description, reference being made to the accompanying drawing in which:

Figure 1 is a perspective view, partly broken away, of an electric panel type space heater which embodies the features of this invention;

Figure 2 is a sectional view taken along line 2-2 of Figure 1 illustrating in more detail the juxtaposition of component parts;

Figure 3 is a perspective view of a modification of the heating element which comprises a resistance wire secured to a carrier sheet;

Figure 4 is a perspective view of a further modification of the heating element wherein a resistance wire is incorporated with the carrier sheet fabric; and

Figure 5 is a sectional view of still another modification of heating element wherein the resistance wire is disposed between a pair of insulating carrier sheets.

Like reference characters refer to like parts throughout the description and the drawing.

The radiant heater panel 10 illustrated in Figures 1 and 2 illustrates a preferred embodiment of our invention in which an electric heating element, such as an electric resistance wire 11 extends in a tortuous path from one end of the panel to the other end and is connected to a switch, not shown, which, in turn can be connected to a source of electrical energy according to conventional practice. The heating element is embedded in an adhesive or cement 14 which is bonded to the inner side 12

of a front housing member 13. The term adhesive or cement is referred to herein by the term adhesive and is intended to include any high-temperature adhesive or cement which is a non-conductor of electricity. Suitable adhesives include, but are not necessarily limited to, thermoplastic synthetic resins, thermosetting synthetic resins and inorganic adhesives such as silicones and the like. It is preferred to use an adhesive which hardens or sets to bond securely to the element the inner surface of the front housing member 13 and which will not soften and flow or lose its electrical insulating properties at temperatures up to at least about 700°F. as it should form a solid, non-electrically conductive layer between the heating element and the front member to preclude short-circuiting or leakage of electricity to the enclosure. The front housing member 13 can be of any rigid, heat conductive material, preferably sheet metal or metal alloy. It is necessary to secure the heating element as close as possible to but safely out of contact with the inner face of the front housing member throughout its length and breadth by means of the adhesive such that heat transfer between the element and the metal sheet will be a maximum while the two are separated and electrically insulated from each other. The dielectric properties of the adhesive, which usually are known but, if not, can be determined readily, usually determines the minimum spacing between the heating element and adjacent metal parts.

It may be preferred to supplement the electric insulating characteristics of the adhesive by coating the inner side 12 of the front housing member 13 with a procelain material and applying the adhesive directly to the porcelain coating. The desirability of this porcelain coating will depend largely on the dielectric and other physical characteristics of the adhesive and the degree of safety required in view of operational hazards in various locations.

A layer 15 of heat insulating material, such as rock wool, glass fibre or the like, is positioned rearwardly of the layer of adhesive 14.

A heat-reflecting sheet 16 formed of aluminum or other material having heat reflective properties is positioned rearwardly of the layer 15 of heat insulating material and is coextensive therewith. The space between the sheet 16 and the rear wall of the housing is filled with a heat insulating material 15a such as rock wool, asbestos or the like. The rear housing member 17 in the modification of the panel illustrated in the drawing is adapted to engage with front housing member 13 at overlapping joint 18 and to be secured thereto by joining means such as self-tapping screws 18a to form a rigid protective housing for the heater element 11, reflector sheet 16, and insulating material 15-15a.

A thermal-break gasket 19 is preferably disposed between the two housing members at joint 18 to reduce heat transfer between them.

The exposed face 20 of front enclosure member 13 preferably is coated with a heat emissive substance such as porcelain, lead and zinc oxide paints, enamels, shellac varnish and the like to improve the rate of infra red emission and to provide a decorative surface coating which can be varied in colour and texture as may be desired. The exterior of rear housing member 17 preferably is uncoated and polished to reduce the rate of infra red radiation therefrom.

Heating element 11 is arranged in a predetermined pattern such as the winding pattern shown to provide a uniform heat supply to the front housing member across the length of the panel. The closeness of the windings is primarily determined by the heat output desired. The power supply may be connected in parallel, series or series-parallel as is well known in the art.

Figures 1 and 2 illustrate an embodiment of the invention in which the heating element 11 is disposed within the adhesive 14 which secures the element to the inner face 12 of front housing member 13. In the modification of the invention illustrated in Figure 3, a resistance wire or ribbon 21 is secured to a carrier sheet 22 by thread 23 to form a unitary heating element indicated by numeral 24.

Figure 4 illustrates a resistance wire or strip 25 woven into the carrier sheet fabric 26. A carrier sheet selected from a chemically inert, electrically non-conductive material

such as glass fibre is preferred. Another embodiment of heating element which can be used to advantage is glass fibre cloth impregnated with an electrically conductive material such as graphite.

Figure 5 illustrates another embodiment of heating element 27 which is secured to the inner side 12 of front housing 13 by an adhesive in the manner as has been described in detail hereinabove. Heating element 27 preferably comprises a resistance wire 28 arranged in a winding pattern and disposed between two sheets of insulating material 29 and 30 such as plastic sheets, mica sheets, asbestos cloth or paper and the like. An adhesive filler 31 secures the resistance wire 28 in place and holds the two sheets 29 and 30 together to form a unitary heating element. Sheets 29 and 30 provide additional electrical insulating properties as well as facilitating incorporation of the heating element to the front housing member.

In each of the embodiments illustrated, the heating element is secured to front housing member 13 by an adhesive such that the heating member is disposed close to inner face 12 to permit maximum heat transfer but is electrically insulated therefrom. The element is coated throughout with the adhesive to insulate the element from all metal parts and is sealed against contact with the atmosphere.

The space heater of this invention possesses a number of important advantages. It can be used as a portable, permanent

or semi-permanent heater in homes and in commercial installations, especially where flame-proof and explosion-proof heaters are essential. By providing heater elements and infra red emitting surfaces on both sides of the panel so-called "hot walls" or "curtain-wall panels" are created suitable for partition walls. Also, portable heating trays and griddles can be fabricated by disposing an embodiment of the heating panel in a horizontal plane. In addition, other ceramic-on-metal articles of manufacture, such as glass-lined water heating tanks, porcelain-on-steel bathtubs, washing machine tubs and the like can be heated electrically without danger to the user.

Also, the heater element can be totally enclosed in an air-excluding electrical non-conductor adhesive in proximity to an efficient infra red emitting surface to provide improved heat transfer from the heating element to the heat radiating member while extending the heating element life and reducing the hazards normally encountered with this type of heater. The heating panel can be readily fabricated from low-cost components in a plurality of sizes, shapes and heat output capacities to satisfy the requirements of users in both the home and industry.

It will be understood, of course, that modifications can be made in the preferred embodiments of the invention described and illustrated herein without departing from the scope of the invention as defined by the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An electrical heater which comprises a rigid front panel having an exposed heat-emissive surface, a layer of electrically non-conductive adhesive secured to the inner surface of said front panel, an electrical heating element comprising a resistance wire or element positioned in proximity to but out of contact with said inner panel surface enveloped by said layer of adhesive, a rigid rear panel substantially co-extensive with the front panel and rigidly secured thereto to form therewith a protective housing for the heater element, and a layer of heat insulating material between the rigid rear panel and the layer of adhesive.

2. An electrical heater as described in claim 1 in which a body having heat-reflecting surface is positioned between the layer of heat insulating material and the rigid rear panel and extends co-extensive therewith, and including means for electrically insulating the body from the layer of adhesive.

3. An electrical heater which comprises a rigid front panel having an exposed heat emissive surface, a layer of electrically non-conductive adhesive secured to the inner surface of said front panel, an electrical heating element comprising a resistance wire or ribbon enveloped by said layer of adhesive out of contact with the inner face of said panel but in a closely abutting spaced relationship to the inner face of said panel, a first layer of thermal insulating material substantially co-extensive with and abutting the heating element, a body having a heat-reflecting surface disposed adjacent said first layer of thermal insulating material and spaced and electrically-insulated from the heating element, a second layer of thermal insulating material substantially co-extensive with and adjacent said body having a heat-reflecting surface,

and a rigid rear panel substantially co-extensive with said front panel and rigidly secured thereto to form a protective housing for the heating element.

4. An electrical heater as described in claims 1, 2 or 3 in which the exposed heat emissive surface of the front panel is coated with a material selected from the group consisting of porcelain, lead and zinc oxide paints, enamels and shellac varnish.

5. An electrical heater as described in claims 1, 2 or 3 in which the adhesive material is selected from the group consisting of thermoplastic synthetic resins, thermosetting synthetic resins, natural and synthetic rubbers and inorganic adhesives.

6. An electrical heater as described in claims 1, 2 or 3 in which the electrical heating element is selected from the group consisting of electric-resistance wire, electric-resistance ribbon, electric-resistance wire secured to a carrier sheet, electric-resistance ribbon secured to a carrier sheet, electric-resistance wire disposed between a pair of insulating sheets, electric-resistance ribbon disposed between a pair of insulating sheets, and graphite-impregnated chemically-inert electrically non-conductive material.

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